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***Archips podana* (Scopoli) (Lepidoptera: Tortricidae) Host Survey 2002 - Northwest Washington Occurrence of an Old World Tree-fruit Pest New to the United States**

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Background

Native to Europe and parts of Asia, *Archips podana* (Scopoli, 1763) was first introduced into North America in British Columbia, Canada sometime earlier this century. Early records of the species in Canada (Freeman 1958) are confused with another similar European species, *Archips oporana* (Linnaeus) (Brown, 2002 USDA Memo), but it was correctly identified (as *A. podana*) in the lower Fraser River Valley of B.C. in 1988, where it was reported feeding on apple, plum, and blueberry (Belton 1988). (NOTE - Both European and North American technical literature variably list the species as *Archips podana* and *A. podanus*, which should be considered synonyms for the same species.)

Specimens of *A. podana* were first collected in the U.S. in 2000, as non-target captures in a WSDA / USDA CAPS pheromone-trap detection survey for European corn borer, *Ostrinia nubilalis* (Hbn., 1796) (LaGasa 2000). In that survey, traps at 15 sites in northwestern Whatcom County captured 183 adult male *A. podana*, delimiting an infested area in the northwest corner of the state (Figure 1.). Confirmation of these first U.S. collections was received in March, 2002 (Brown, 2002 USDA Memo) which prompted a USDA APHIS New Pest Advisory Group review of the current information and Risk Assessment for the exotic pest species.

In Europe, *A. podana* (Figure 2.) is considered one of the most abundant and damaging tortricid species occurring on fruit crops (Alford, 1999). The leafrolling-larvae damage the fruit of apple, pear, plum, blueberries, cane-berries and other plants, and feed on the leaves of many forest and ornamental trees, including maple, oak, elm, walnut, birch, hawthorn, and others.

2001 Project Objectives

1. **Determine local *A. podana* host plant preferences.**
 - Rear leafroller larvae from selected host plants to adult.
 - Identify the adults produced and associate host plants.
2. **Observe and record *A. podana* biology and larval parasitism.**
 - Identify parasitoids and defoliator host species reared.
 - Capture digital graphics of EPSB life stages, biology, and feeding damage where possible.

Figure 1. 2000 *Archips podana* collection sites.



Figure 2. Adult Male *Archips podana*



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Project Methods and Materials

Fruit trees and ornamental plants known to be *A. podana* host plants were searched for leaf-roller damage or larvae in selected areas near sites where higher numbers of *A. podana* adults were collected in 2000.

Rolled/damaged leaves and larvae were collected along with additional host leaves and transported to the WSDA Olympia Entomology lab, where all larvae were individually reared on either artificial diet (apple feeding species) or host plant leaves. Larvae were photographed periodically during rearing to produce reference graphics, which were identified to species from adults moths produced. All adult moths and parasitoids produced were identified when possible, photographed as needed, and selectively curated into the WSDA Olympia Entomology Collection.

Host plants which produced larvae included; apple, pear, plum, cherry, blackberry, rose, alder, aspen, amelanchier (serviceberry), hawthorn (native), mountain ash, poplar, and hydrangea.

Digital image files created for this project were captured with a Nikon® 990 camera, hand-held or mounted on a Leica® MS5 microscope, and macro-photographic images were created using daylight-corrected fiber-optic incandescent lighting and mylar diffuser-filters. Images were also cropped, adjusted, and labeled with Photoshop® 5.5.

Project Results and Discussion

In total, 461 individual leaf-damaging larvae were collected and processed in this survey. Of these, 333 specimens were either successfully reared to the adult moth stage or produced parasitoids. A list of leaf roller species reared, which numbered 18 total, the numbers of each reared, and a count of parasitoids or larval mortality is presented in Table 1.

A. podana was reared from 5 host plants, including (in order of abundance) **apple, native hawthorn, mountain ash, plum, and amelanchier (serviceberry)**. Damage from *A. podana* and other leafroller larvae was not particularly prominent on any of the host plants sampled in the area and timeframes of this project. Where it was found, *A. podana* occurred in fewer numbers than other leafroller species. A summary of the number of *A. podana* larvae reared and the percentage of all larvae reared by host plant is listed in Table 2.

Table 1. 2002 Leafroller and parasitoid specimens reared.

Species	Number Reared
<i>Acleris</i> sp.	2
<i>Acleris variegana</i> (Denis & Schiff.)	74
<i>Archips fuscocupreanus</i> Wlsm.	1
<i>Archips podana</i> (Scopoli)	25
<i>Archips rosanus</i> (L.)	37
<i>Caloptilia</i> sp.	2
<i>Chloroclystis rectangulata</i> (L.)	1
<i>Choristoneura rosaceana</i> (Harris)	13
<i>Croesia holmiana</i> (L.)	95
<i>DiTula angustiorana</i> (Haworth)	1
<i>Epinotia albangulana</i> (Wlsm.)	5
<i>Hedya nubiferana</i> (Haworth)	13
<i>Olethreutes</i> sp.	1
<i>Pandemis cerasana</i> (Hubner)	1
<i>Pandemis heparana</i> (Denis & Schiff.)	43
<i>Recurvaria nanella</i> (Denis & Schiff.)	2
<i>Rhopobota naevana</i> (Hubner)	1
<i>Spilonota ocellana</i> (Denis & Schiff.)	17
Parasitoid reared or larva died	127
Total specimens	461

Table 2. *Archips podana* rearing results by individual host plant.

Host Plant	# Leafroller Species Reared	Total # Larvae Reared at Host/Site	# of <i>A podana</i> Reared	<i>A podana</i> % of Total Larvae
Alder	1	1	0	-
Alder	1	4	0	-
Amelanchier (serviceberry)	6	16	1	6.25%
Apple	3	3	0	-
Apple	7	23	1	4.35%
Apple	8	34	9	26.47%
Apple	3	6	0	-
Apple	1	1	0	-
Apple	1	1	0	-
Aspen	4	5	0	-
Cherry, cultivated	1	1	0	-
Cherry, cultivated	3	5	0	-
Hawthorn, native	12	108	7	6.48%
Hawthorn, native	2	10	0	-
Blackberry	1	1	0	-
Hydrangea	2	2	0	-
Mountain ash	5	15	4	26.67%
Pear	5	11	0	-
Pear	1	1	0	-
Plum	1	1	0	-
Plum	1	1	0	-
Plum	7	75	2	2.67%
Plum	3	5	0	-
Plum	2	2	0	-

Project Results and Discussion (Cont.)

Identification of *Archips podana* larvae collected in this survey proved to be difficult, due to the occurrence of similar larvae of another introduced (long established) exotic species in the survey area; *Archips rosanus* (L.), known in the region as the European leafroller or filbert leafroller. While microscopic physical characters may exist to differentiate larvae of the two species, a comparison of gross anatomy features failed to distinguish between the species (e.g. comparison of head, thoracic plate, body, leg, and anal plate color). This similarity was also apparent in both the immature (mid-instar) and mature larval forms. Larvae of both species are presented here to show the similarity (Figures 3-8).

Figure 3. Immature *Archips podana* larva.**Figure 4. Immature *Archips rosanus* larva.****Figure 5. Mature male *Archips podana* larva.****Figure 6. Mature male *Archips rosanus* larva.****Figure 7. Mature female *Archips podana* larva.****Figure 8. Mature female *Archips rosanus* larva.**

Adult *Archips podana* moths, in contrast to the larvae, were found to be distinctive, particularly males, and also were found to occur in varying of forms of wing color and pattern. Examples of the more typical color patterns for the sexually-dimorphic adult moths are presented in Figures 9 and 10.

Figure 9. Adult male *Archips podana*.**Figure 10. Adult female *Archips podana*.**

Project Results and Discussion (Cont.)

The forewing color and pattern variation noted among adult specimens reared in this study included two basic “schemes”, including the more typical (common) configurations shown (Figures 9 and 10) and a darker brown and purple form. Examples of the variant color forms reared are presented in Figures 11 through 16.

Figure 11. *A. podana* male - common form



Figure 12. *A. podana* male - common form (darker variant)



Figure 13. *A. podana* male - dark form (purple/brown)



Figure 14. *A. podana* female - common form



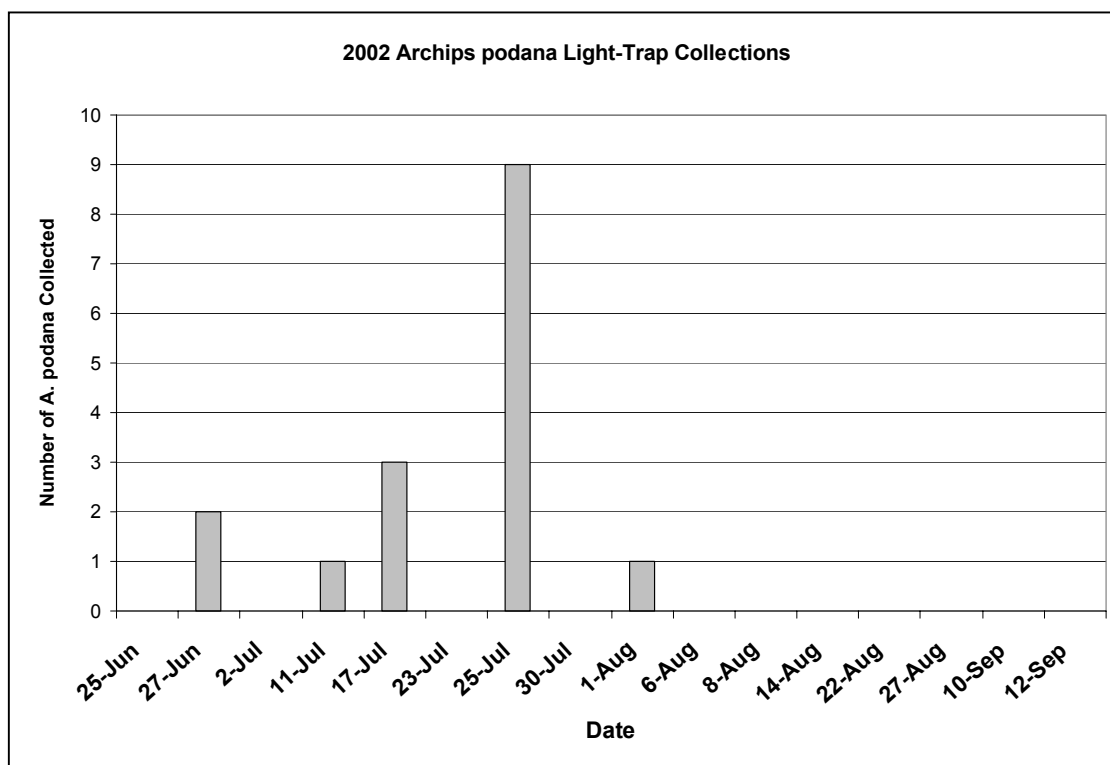
Figure 15. *A. podana* female - common form (darker variant)



Figure 16. *A. podana* female - dark form (purple/brown)



Adult *A. podana* flight was recorded (in part) in light-traps present in the area of this survey for another CAPS detection survey (LaGasa et. Al. 2002). Light-trap collections were recorded between June 27 and Aug 1, with an apparent peak in late July. Collection dates and numbers of adult *A. podana* are presented in Figure 17., and location of the light-trap survey site (near the U.S./Canadian border at Blaine, WA) is shown on Attachment 1.

Project Results and Discussion (Cont.)Figure 17. 2002 Adult *Archips podana* Light-trap Collections.

A number of parasitoids (all parasitic Hymenoptera spp.) were reared from suspect *A. podana* larvae in this project. However, due to the difficulty separating (identifying) *A. podana* and *A. rosanus* larvae collected in this survey (see page 2), parasitism rates and parasitoid species associated with *A. podana* are not available at this time. It is possible that on-going collaborations with systematic researchers may provide the ability to identify the species of parasitoid-killed host larval remains (curated with reared parasitoids) through genetic analysis. Reared adult *A. podana* specimens and larval remains from parasitoid-killed host larvae have been provided to research staff, and results (positive or negative) should be available in early 2003. Once available (and if successful), that data will be reported separately (contact the author for more information).

Interestingly, one species of parasitic hymenoptera reared from *A. podana* and/or *A. rosanus* in this project is a European species considered to be a principle control for *A. podana* in Europe. That species, *Macrocentrus linearis* (Nees) (Braconidae: Macrocentrinae), is a gregarious parasitoid that has been cultured and released for biological control of European corn borer and other pest moth species in North America. Previous CAPS defoliator rearing surveys (that didn't include *A. podana*) recorded the parasitoid only once, from a native leafroller species. More information on *M. linearis* and previous CAPS defoliator parasitoid surveys are available at:

<http://whatcom.wsu.edu/pestsurvey/defoliator.htm>

Figure 18. *Macrocentrus linearis*

Pertinent Literature

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Attachment 1. Whatcom county *A. podana* collection sites (Map).

